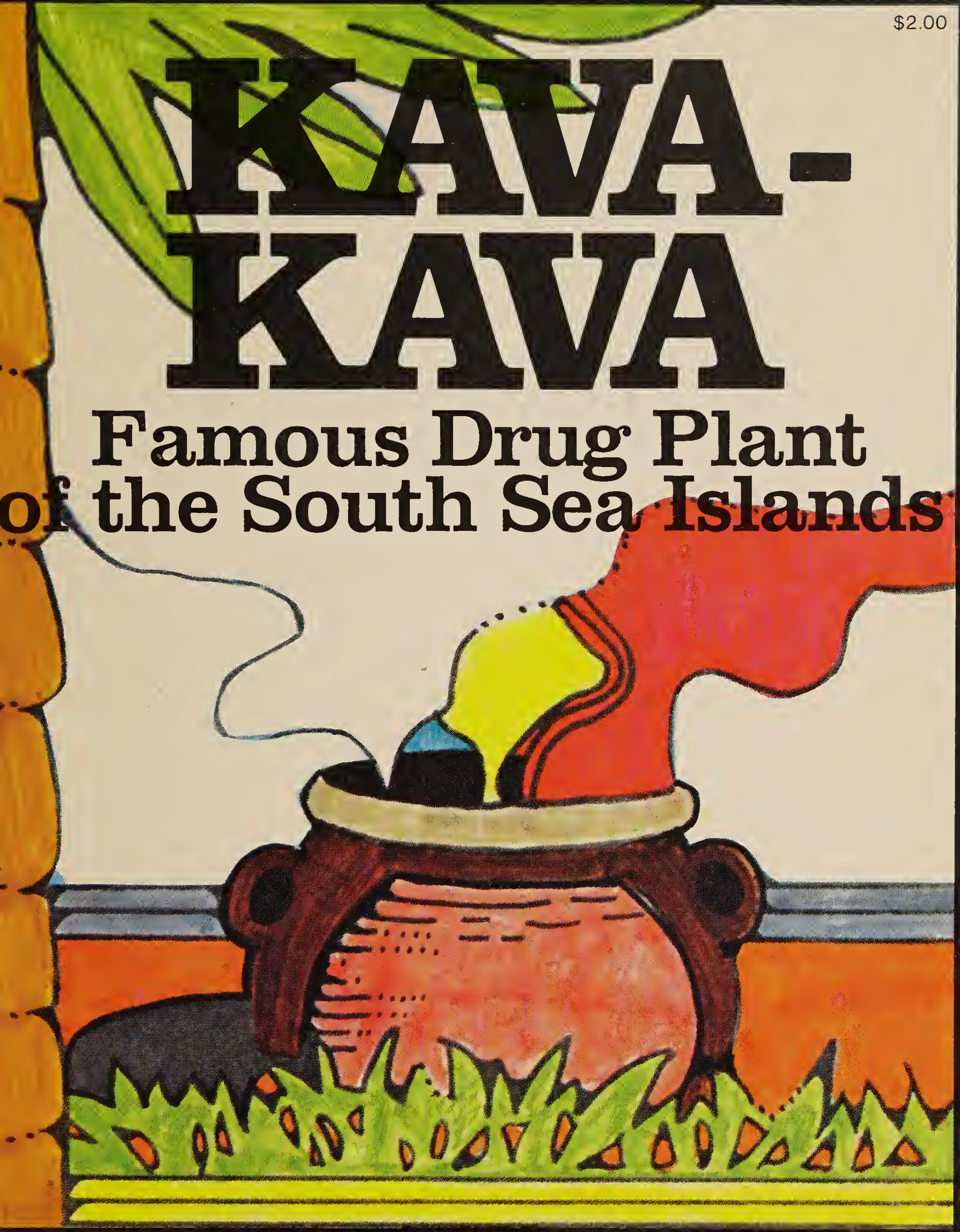

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KAVA-KAVA

Famous Drug Plant of the South Sea Islands

By E.F. Steinmetz

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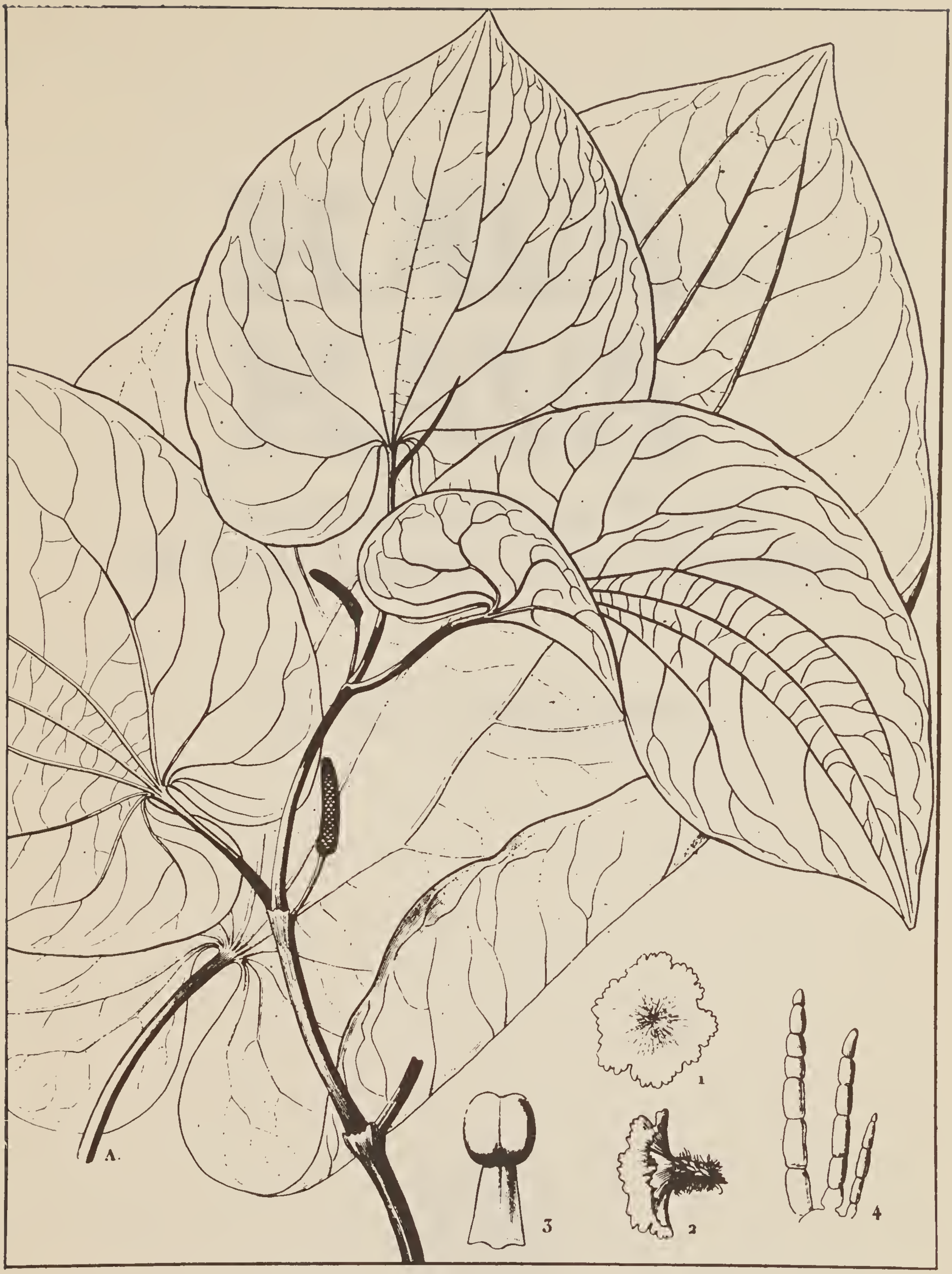

PIPER METHYSTICUM FORST.

Reproduced from: De Lessert, Benj. "Icones selectae plantarum", Vol. III, 1837, *Tab.* 89.

- *A. Folium maximum subtus visum*
- 1. *Squama floris explicata, intus visa aucta*
- 2. *Eadem latere visa*
- 3. *Stamen auctum*
- 4. *Pili articulati squamam vestientes, valde amplificati*

KAVA-KAVA

Famous Drug Plant of the South Sea Islands

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HIGH TIMES/LEVEL PRESS

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Third Printing

FOREWORD

Since the earliest times mankind has sought and often found relief from its diseases and disorders in the use of medicinal plants.

Throughout the ages scientists have studied and observed the healing properties of plant materials and an extensive knowledge has been gained about them.

In spite of the fact, that a large number of species of plants is known to possess medicinal powers, we are far from having exhausted the possibility of new discoveries in this field. Striking examples in recent years have been penicillin and Rauwolfia root.

From time to time, a plant drug - after having been turned down or forgotten - suddenly becomes well known again, because of a new healing power that has been detected in the crude drug or in one or more of its constituents. Sometimes - as in the case of kava rootstock - a drug has been dropped as a result of lack of knowledge as to the right method of administration.

Kava was used in the South Sea archipelago, long before white men discovered the islands.

The author has made an exhaustive study of the kava drug and has pleasure in publishing the present booklet. All old and recent literature, to which he had access, has been carefully examined, so that this compilation contains the most important details concerning the subject.

The author trusts that this booklet may induce research workers in the field of therapy to make strong efforts in manufacturing stable medicinals, as outlined in the last chapter of this essay. With modern tools available, there should be no difficulty to achieve the best results, thus contributing to better therapeutic values and to human welfare.

Procurement of adequate supplies of crude kava is at present somewhat difficult, but this difficulty can certainly be overcome. Interested parties may contact the undersigned. Meanwhile a sufficient supply of material for purposes of laboratory investigation and clinical testing is available; see end of chapter 10.

E. F. Steinmetz, Sc.D.

Amsterdam - 1960

347 Keizersgracht, Amsterdam (Netherlands)

CHAPTER 1

Natural range and habitat

PIPER METHYSTICUM[1] Forst. (synonyms MACROPIPER[2] METHYSTICUM Miquel, PIPER DECUMANUM[3] Opitz, PIPER INEBRIANS[4] Soland. ex Parkins. and Bertero) is a robust somewhat succulent, coarsely and sparingly branching, rather erect perennial shrub belonging to the family PIPERACEAE, indigenous to the greater part of Polynesia, Micronesia, Melanesia, the Hawaiian Islands (once called the Sandwich Islands) and related Oceanic regions, collectively known as the South Sea islands or South Pacific islands; however the plant does not occur on all of the many islands, and its precise home is not known. It is also found in some areas of South New-Guinea and the northern coast of the former German part of New-Guinea (known as Maclay[5] coast). It no longer occurs in Tahiti or in the Philippine Islands.

In Fiji, the plant, the root, and the beverage prepared from the rhizome (rootstock) are called *yaqona* (pronounced yanggona); in other Pacific islands *kava* or *kava-kava*, *kawa* or *kawa-kawa*[6], and *ava* or *ava-ava*[7] or *awa*. In Germany it is known in trade as "Rauschpfeffer" (literally: intoxicating pepper).

CHAPTER 2

Plant habit and cultivation

PIPER METHYSTICUM (Kava - as it is called in the course of this paper) occurs on the islands of the Pacific, mentioned in chapter 1, and is also cultivated on the island of Hawaii, State of Hawaii. The best plants thrive at altitudes up to 1000 feet above sea level, in cool, moist highlands and grow well on stony ground, both wild and cultivated, to a height of about 6 to 8 feet; in places where summer temperatures are usually between 80° and 90° F and with sufficient sunlight, the plant grows densely to a height of about 20 feet. It develops slowly and bears flowers (which consist of catkins) for the first time only after 2 1/2 to 3 years, but flowers - which are dioecious[8] are rarely found. The small, white, spikelike flower develops into a one-seeded berry, not unlike small pepper corn.

The plant, which is a stocky, non-climbing bush, is propagated by offshoots (cuttings) and is commonly cultivated, especially in the Fiji and Samoan islands, preferably on virgin soil which naturally supports a fairly heavy jungle vegetation. In Fiji it is quite a valuable crop, but little of the root is exported at present because of the large local demand.

In planting, spacing is about 6 x 6 feet, furnishing about 1200 plants to the acre. A rich soil and good drainage are essential. If two successive crops are taken off the same land, the second is poor[9].

In the Pacific islands, cultivation is mostly carried out on a commercial scale by Indians (in Fiji) and to a smaller extent by Chinese. The original inhabitants often grow the plant for their own use in private gardens.

CHAPTER 3

Description and varieties

The leaves of the plant are few in number, simple, thin, fairly large, round or cordate (heart-shaped), pointed, smooth, green on both sides, about 3 to 6 inches in length, sometimes wider than long, and are caducous (i.e., have a tendency to fall or decay) in acropetal succession.

The glabrous, fleshy stems of the plant (which proceed from the rootstalk) are usually 1 to 1 $^1/_2$ inch in diameter. They arise from the knotty crown - which is about 2 to 6 inches thick - at ground level, and in the early stages are branched; but as the stem matures the lateral branches fall off, leaving conspicuous nodal scars, so that, when it has reached maturity, the plant appears to consist of a number (10 to 20) of separate unbranched stems, arising from an extensive base or crown

The rootstock is usually swollen, soft-wooded to succulent, giving off numerous lateral fibrous roots.

Of this species of pepper there are many (probably fifteen) varieties, distinguished by the height of the entire plant, the length and thickness of the joints, and the more or less purplish or greenish tinge of stems and leaves. The five varieties occurring in the Fiji islands - now the largest producing areas of kava - are:

1. White variety: Fijian name Kasa Leka. Stem about 1 $^1/_2$-2 inches in diameter, leaf scars broad (1 inch), close together, i.e., internodes short (2-2 $^1/_2$ inches long), stem green speckled with transverse lenticels; this plant is very abundant.
2. White variety: Fijian name Kasa Balavu (Yalu). Stem slender 1 $^1/_2$ inch at nodes, $^3/_4$ inch at internodes, leaf scars small, depressed,

Piper Methysticum, *growing in cultivation at* 1000 *feet. This two year old plant is* 5 *feet high. Through permission of Bernice P. Bishop Museum, Honolulu (Hawaiian Islands).*

1/2 inch in diameter, internodes 5-10 inches long, stem pale green, lenticels linear, vertical; the plant's range is dispersed.

3. White variety: Fijian name Qolobi. Stem more slender, only 1 1/4 inch at node, 3/4-1 inch at internode, leaf scars 1/2-3/4 inch, internodes 3 1/2-4 inches long, stem green, lenticels few, punctate, confined frequently to the upper portions of internodes. Ratio between diameter of node and internode very marked, of the order 2:1
4. Black variety: Fijian name Kasa Leka. Stem green-black, scars 1 inch in diameter, node/internode ratio 3:2, internode 3-5 inches long, lenticels dispersed, circular to transverse.

5. Black variety: Fijian name Kasa Balavu. Stem slender, black, internodes 9-12 inches or more in length, 1 inch or less in diameter, scars 1/2-3/4 inch, node/internode ratio 3:2, lenticels linear and vertical.

The white varieties are considered to be the source of the best kava, but they take longer (about 4 years) to attain maturity, than the black varieties (about 2 1/2 to 3 years). Owing however to the fact that the latter mature earlier, they have been grown on a large scale in commercial plantations.

Allied species

Piper Excelsum Forst., is a native of New Zealand, resembling Piper Methysticum in appearance, and is also called kawa or kawa-kawa by the Maoris. It does not possess the properties of Piper Methysticum, but the leaves are reported to be used in the form of an infusion (tea) in case of headache. The leaves of this plant are only about half the size of those of Piper Methysticum.

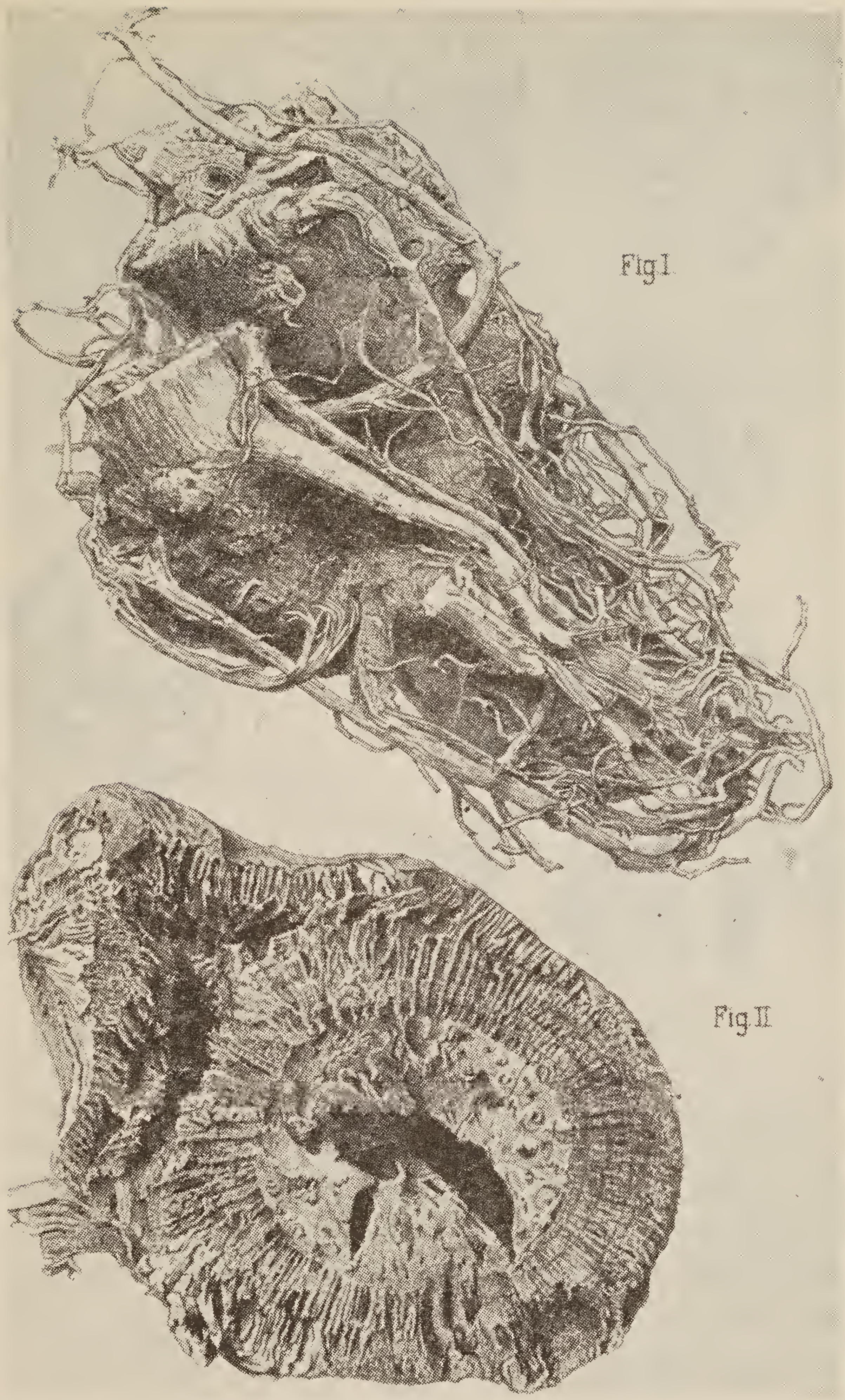
Piper Latifolium Forst., found in the Marquesas islands, also resembles Piper Methysticum in appearance, but is smaller and more shrublike. The plant is known in these islands as Bakavatua. In the Society Islands - where it is rare - it is called Avavahai. Usage is not recorded.

Piper Plantagineum Schlecht, a plant of the West Indies (Mexico), is used there by the natives in a similar way as kava, namely as a narcotic. It does not seem to be thoroughly examined yet.

CHAPTER 4

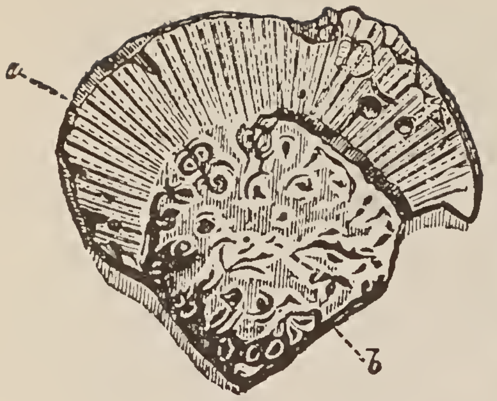
Structure of Kava Root

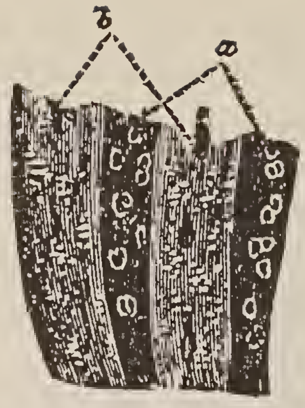
The rhizome (rootstock), scraped clean at place of origin from its outer corky layer, is found in commerce in pieces usually weighing from 2 to 10 lbs. The product is cut and dried into segments varying from 1 to 3 inches in length and 1/2 to 2 inches in diameter. The rhizome is longitudinally wrinkled and has large circular root scars; externally yellowish-gray, internally whitish with light-brown or dark-brown spots; fracture of small pieces short and somewhat splintery; fracture of thicker pieces tough; central portions porous with a large pith and a distinctly radiate xylem; irregularly twisted wood bundles separated by broad medullary rays of a sclerenchymatous nature, so that under the thin bark - underlaid by a very thin cortical layer - the wood bundles form distinct meshes.



KAVA RHIZOME

From Lewin, L. - Piper methysticum,
Berlin 1886. *Paul Geissler Kunstwerkstatt, Berlin*





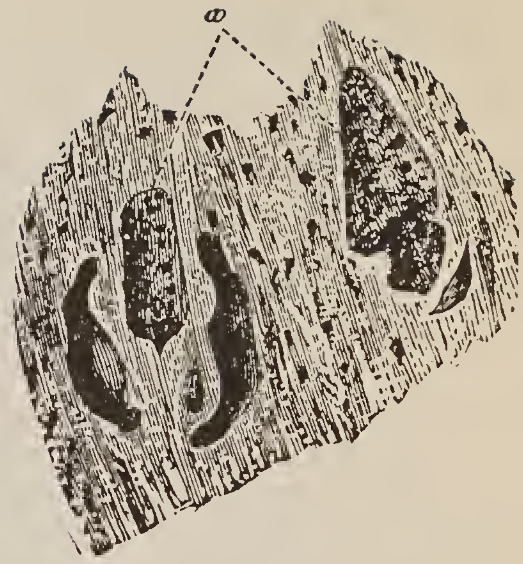


Fig. 4.

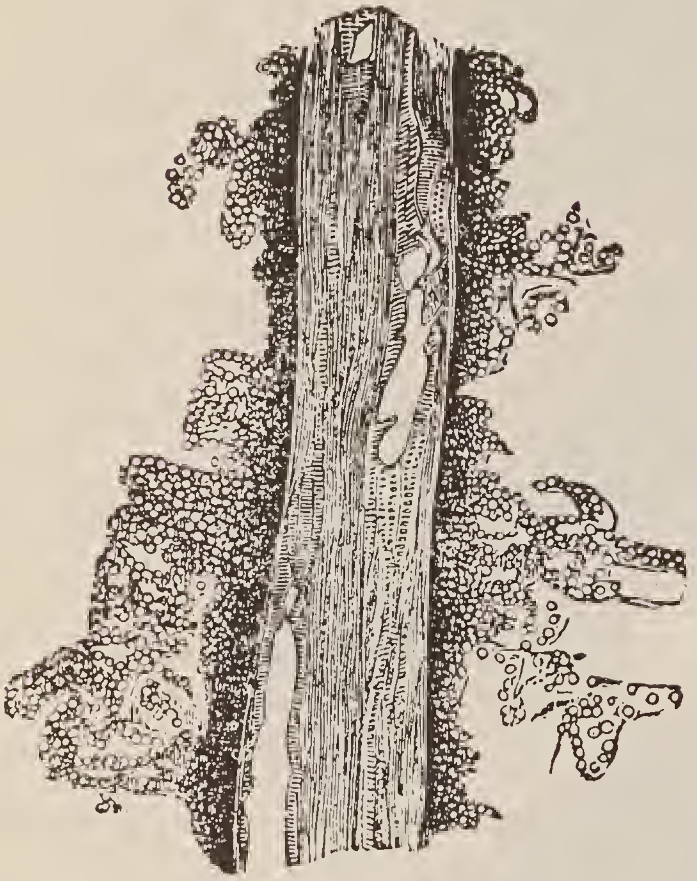
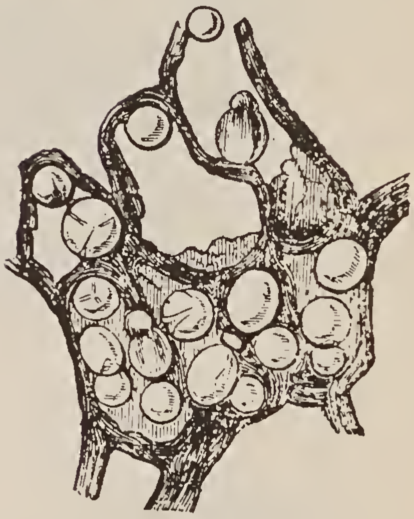


Fig. 5.



From a drawing by Mr. Alfred White

Fig. 1 *Cross section of the stem (natural size), which is composed of an outer layer (a), in which plates of woody and vascular tissue alternate with masses of small cells, filled with starch grains, and likewise a few vessels; and of a central accumulation of cells, filled with starch grains; through these pass large bundles of vascular and woody tissue.*

Fig. 2. *Represents the outer layer, magnified* 12 *times; (a) being the woody and vascular plates, and (b) those of cellular tissue.*

Fig. 3. *Is a portion of the cellular mass, magnified* 12 *times; (a) the vascular bundles, surrounded by the cellular tissue.*

Fig. 4. *A longitudinal section of one of the vascular bundles (of the central part), with its surrounding cells and starch grains; magnified* 25 *times.*

Fig. 5. *A few cells - of the centre -, magnified* 200 *times; showing the manner in which the grains of starch are placed.*

Unscraped rhizome is of a blackish-gray colour externally. Pieces of stem are more woody than the rhizome and have a hollow pith.

The roots, when not removed, are often 12 inches or more long (sometimes up to 6 feet), more or less fibrous and of a grayish-brown colour.

Older rhizomes can be distinguished by numerous splits and holes, caused by the destruction of the parenchyma tissues.

A drop of sulphuric acid, applied to the surface of the rhizome, produces a deep cherry-red colour.

The rhizome and the stem abound in wood fibres, which - with starch (also existing in immense quantity) - constitute its great bulk. From the edges of the pithy centre, consisting of cells filled with starch grains, proceed plates of woody and vascular tissue, alternating with small cells filled with starch.

CHAPTER 5

Harvesting the Rootstock

Rootstocks can be dug up from time to time as required. For their ceremonies, the natives prefer the fresh rootstock to the dried, though it has been found that the latter is nearly as strong. Sometimes the stems are also harvested.

The rootstock - just below the surface of the ground, and for 2 feet or so - becomes 3 to 5 inches thick at maturity, which is about 2$^1/_2$ to 4 years after planting (see chapter 3). In a patch of kava, the roots eventually become a heavy, knotted mass, and such a patch is highly prized, for the rootstock gathers strength and flavour with age.

When the plant is cultivated on a commercial scale, a good crop can be obtained in 3 or 4 years after planting, each plant averaging 3 lbs. of dried rootstock. The rootstock is full-grown after a period of 6 years and then its weight sometimes exceeds 20 lbs., but it seldom is left untouched until such a long time has elapsed. Roots about 20 years old can have a weight of more than 100 lbs., but are a rarity. In Hawaii, many rootstocks, *after* drying produce up to 20 lbs. in 3 or 4 years after planting.

The older rootstocks and stems carry a higher percentage of the active principles than the younger parts.

To prepare them for the market, the rootstocks and the underground basal parts are scraped, in order to remove the outer coat. Then they are cut into pieces and dried in the sun, or in an airy spot on a platform

over a fireplace. In Hawaii, drying is done in a nearly airtight shed, heated by Ohia logs, after the rootstock is first chopped into small pieces, each weighing 1/2 ounce to 1 1/2 oz., or shredded. Diseased portions are usually cut out. During the drying process the weight diminishes to between one fourth and one sixth.

Formal presentation of a root of Kava.
The Kava usually represents "the first fruits of the land" and is presented as a mark of homage to the high chief, or as a mark of welcome to honoured visitors.
Courtesy: Public Relations Office, Suva (Fiji)
Fiji Official photograph No. G 4085.

PAGE 10, TOP PHOTO:

Spoil from the plantations
- Taro, Coconuts, and Kava (Yaqona) -
from " The Fijians" by Basil Thomson, London 1908

PAGE 10, BOTTOM PHOTO:

Kava on the Municipal Market, Suva (Fiji Islands).
In the left corner two heaps of stems in segments,
and at right a bundle of roots -.
Public Relations Office, Fiji - Official photograph.

CHAPTER 6

History

Since olden times, the natives in many areas of the South Pacific islands (in fact throughout the Pacific beyond the betel-chewing belt) have used the bruised rootstock of the kava plant as a national beverage to relax body and mind, to induce refreshing sleep, as well as to ease pain.

Captain *James Cook*, the discoverer of the islands, was the first European, whose attention was drawn to the custom of kava drinking; the peculiar method of ceremonial preparation and the effect of the beverage received his special attention.

Daniel Carl Solander - a Swedish botanist and pupil of *Carl v. Linné* - and *Sydney Parkinson* - an artist with the task to make drawings of newly discovered plants - accompanied Captain *Cook* on his first voyage with the "Endeavour" (1768-1771). The *Forsters* (father and son) accompanied *Cook* on his second voyage (1772-1775). No doubt *Solander* and *Parkinson* were the first white men who saw and described the kava plant, but the notes of *Johann Georg Forster* were published first.

The beverage forms a national drink, widely used as a token of respect and goodwill, and is a ritual drink at magico-religious and ceremonial occasions. For a white man to ignore the etiquette followed at a kava party would be considered the height of ill-breeding. Nowadays the drinking of kava is not confined to ceremonies; there is always a bowl of kava in the villages as well as in many offices in the towns, and it is also drunk by most Indians and some Europeans in the South Pacific islands.

From the following chapters the reader can observe that there are two methods of preparing the beverage, namely 1): by *chewing* and 2): by reducing the rootstock through *grating or pounding* and macerating in cold water or coconut milk, and that THE EFFECT OF THESE PREPARATIONS IS QUITE DIFFERENT.

In former days the beverage, prepared by chewing, was only drunk by the grown-up males, and was purely a religious rite. The beverage is astringent and peculiarly pungent, but not bitter. Women and children were excluded from the drinking parties; however, emancipation has set in and drinking by women is now mentioned. Nowadays, women drink mostly the far less potent beverage prepared through grating or pounding.

As to the beverage prepared by *chewing*, its refreshing, cleansing properties are highly spoken of by those, who have tasted it. This drink is served with a special ceremony. Kava is an integral part of the religious and social life of the natives; drinking it is essential on occasions of hospitality and feasting, but the ritual varies considerably in the various islands or groups of islands. The drinking of kava is more a kind of ceremonial rite than debauchery.

Kava is a habit-forming drink ,,irresistable, once its taste is acquired'', it is said. As used today in most of the Pacific islands (namely macerated in cold water after having been grated or pounded), it appears to be relatively innocuous, perhaps comparable to beer drinking, an effect referred to as a tonic and stimulant, whereas that of the beverage prepared by chewing is definitely narcotic.

It is said that white men in the Pacific have readily taken to kava drinking, for "its thirst-quenching and stimulating properties are unequalled". The - at first soapy - taste soon changes into a not unpleasant feeling of freshness of the mouth, which lasts at least two hours. The drink refreshes body and mind after long journeys, etc., provided it is taken in moderate quantity.

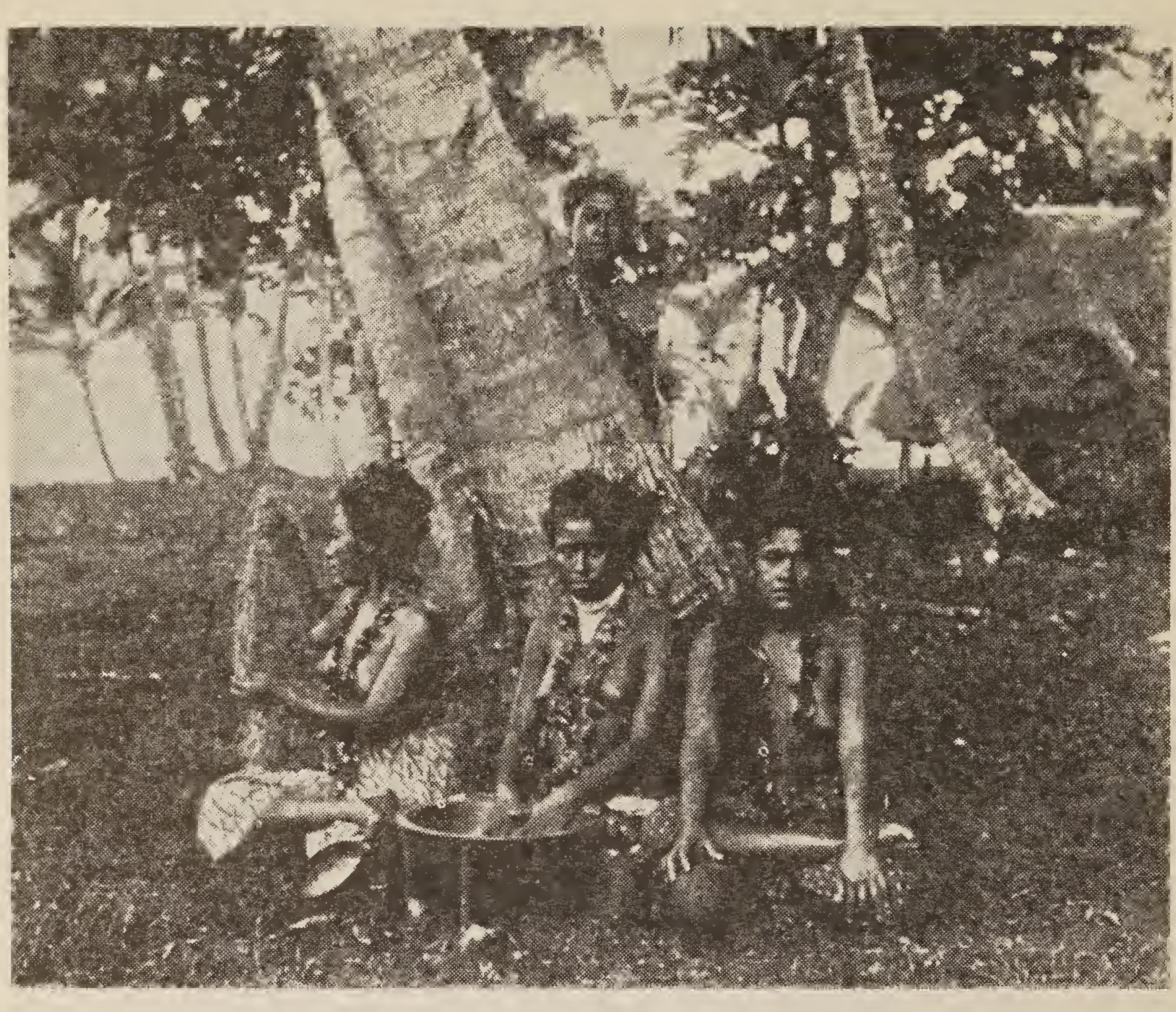
When the white men came to the Pacific islands, they plied the natives with liquor and taught them how to distil spirits. As these spirits were more potent than kava, the natives eagerly drank them, as they did the comparatively harmless kava, and use of the latter decreased temporarily. Nowadays the islanders drink kava again, but in a much weaker solution, though in larger quantities, and then mostly prepared by macerating the grated or pounded rootstock in cold water or coconut milk.

It is not right to condemn the drinking of kava for being the source of the same social evils, that come in the wake of alcohol. Quite a few European drunkards residing in the Pacific are said to have cured themselves by substituting kava for spirits.

CHAPTER 7

Preparing the Kava Beverage

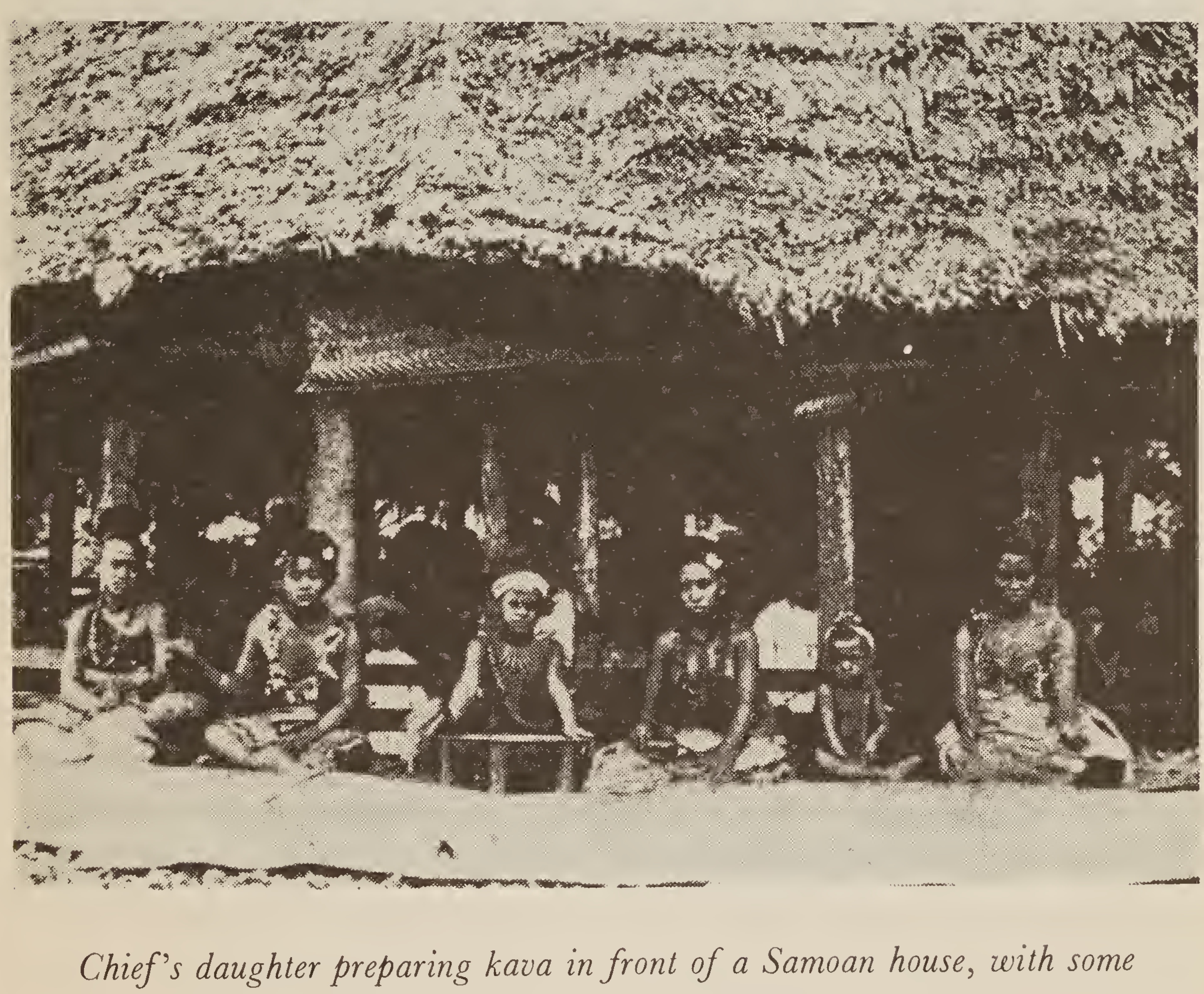
In former days - up till now, though in a lesser degree - the Pacific islanders prepared the beverage in a filthy, disgusting manner, as has been told by travellers, who visited the islands. The cleaned and scraped rootstocks (called "waka" in Fiji), the roots, and the extreme base of the stem (called "lewena" in Fiji) were beaten on a stone and reduced to fragments. Then they were chewed by men, women, and especially by healthy boys and girls with strong jaws and good teeth. They chewed, often until fatigued; care was taken that nothing was swallowed. When



Preparing kava beverage in Samoa by girls in their usual dress. Utensils used: bowl in the middle, coconut shell nearby; "fau" held up by person in the middle of the picture. - Photograph - taken in the Samoan Islands in the pharmacognostical collection of the School of Pharmacy, University of Wisconsin, U. S. A.

masticated, the drug is sialagogue and causes a burning sensation followed by a persistent anaesthesia of the tongue. The saliva becomes more viscid than usual. After diligently reducing to a soft, comminuted mass with saliva, the quid was spit into a half-coconut shell or calabash and, together with other quids so treated, placed in a bowl (usually a circular, shallow wooden vessel standing upon many - up to fourteen - short legs); these bowls vary in size from 9 to 36 inches in diameter. The mass was then mixed with cold water or coconut milk[10] until it reached the right consistency. The supernatant liquid formed the kava potion, a froth resembling soapsuds, an opaque, yellowish liquid. Usually the mass was stirred by hand and then cleared by passing a bundle of the very narrow strips of the fibres, obtained from the inner bark of a tree - *Hibiscus tiliaceus* - (called *Vau* in Fiji, *Fau* in the Samoan Islands, a very common tree along the shores of the Pacific islands) through the contents of the bowl[11]. The liquid was then wrung out by kneading the fibres 3 or 4 times (sometimes the mass was strained through dry grass or through the fibre of a coconut husk), so that the woody disintegrated pulp and dregs remained in the strainer. Finally the strainer was again dipped into the contents of the bowl and squeezed out as a sponge to fill the cups.

The chiefs and the priests used to have their own chewers[12] in their service; they possessed beautifully carved and polished bowls, called *tanoa* in most of the Pacific islands, often cut (legs and all) out of a solid section of the dark-brown wood of the *Vesi* (Fijian name for *Afzelia bijuga*; some of such bowls are now in museums. They are remarkable specimens of wood carving[13].

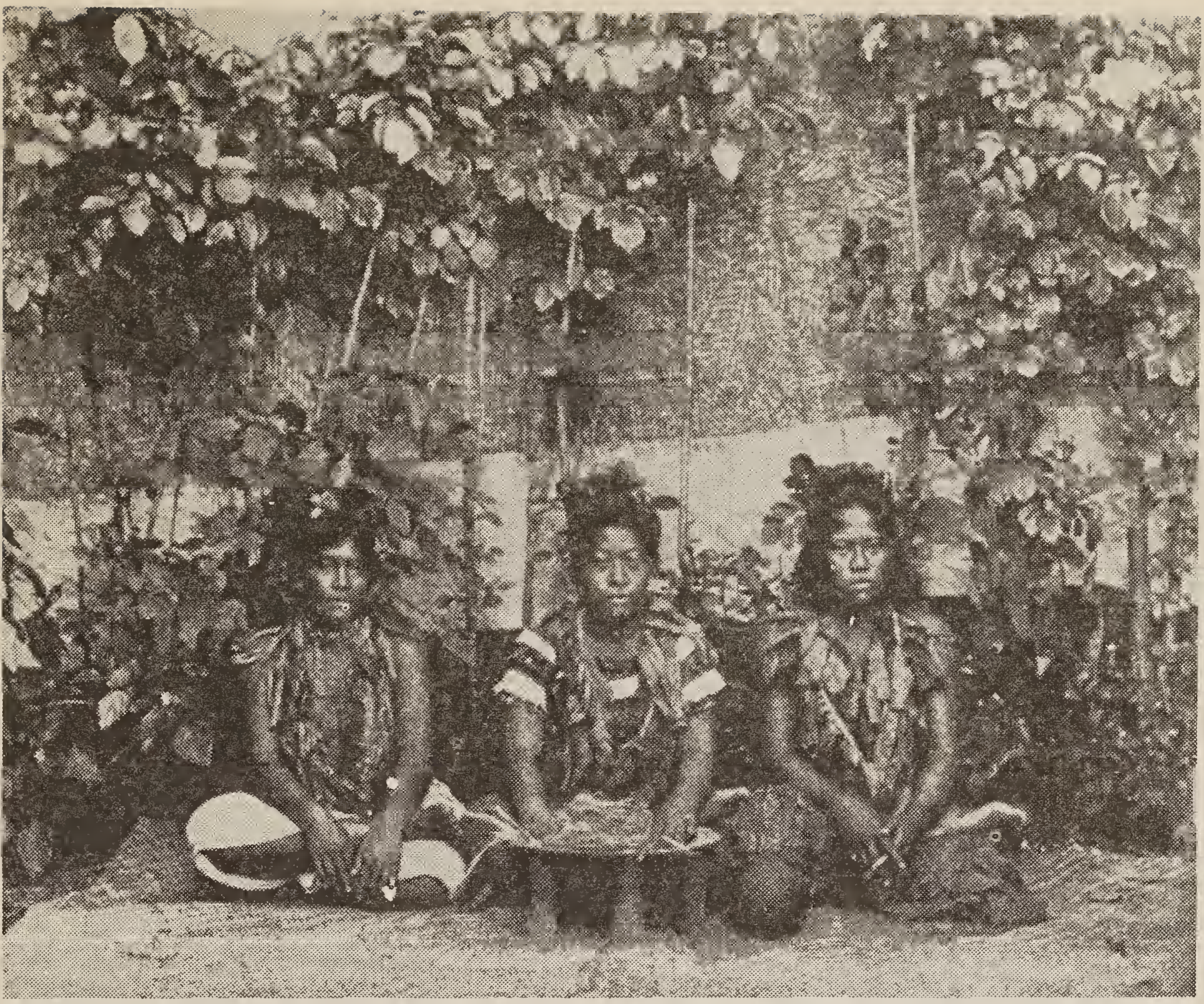


Chief's daughter preparing kava in front of a Samoan house, with some of her assistants. In front of her the kava bowl. In her right hand the kava strainer ("fau"). In the hand of the girl on her right a drinking cup. In the hand of the girl on her left two coconut "bottles". - From "Die Samoa Inseln", 1902, *by A. Krämer.*
Reproduced by courtesy of the
E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.

Kava making in Samoa. First published by A. Krämer, "Die Samoa Inseln", 1902, *Reproduced by courtesy of the E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.*

Nowadays kava beverage is mostly prepared in a more hygienic way, namely by grating or pounding the rootstock between two stones (with a small boulder on the concave top of a larger boulder) or pulverized mechanically, mixing it with cold water, and straining the liquid through fibre, after it has been thoroughly stirred with the hands for 5 or 10 minutes. This task is mostly accomplished by a young girl, preferably a virgin, who first washes her hands and wrists for the occasion. The average quantity is about half an ounce (about 15 grams) of the powdered rootstock to one pint (about 1/2 liter) of water or coconut milk, but the strength of the liquid is liable to considerable variation.

It has been ascertained that this modern way of preparation produces a drink FAR LESS POTENT AND QUITE DIFFERENT IN ACTION than that, obtained through the old practice of chewing, since the main factor affecting potency in the latter, lies in the degree of sub-division of the active resinous principle. Chewing is necessary to reduce the rootstock to minute particles if a *narcotic* effect is to be obtained. The habit of indulging in kava beverage, prepared by chewing, appears to be dying



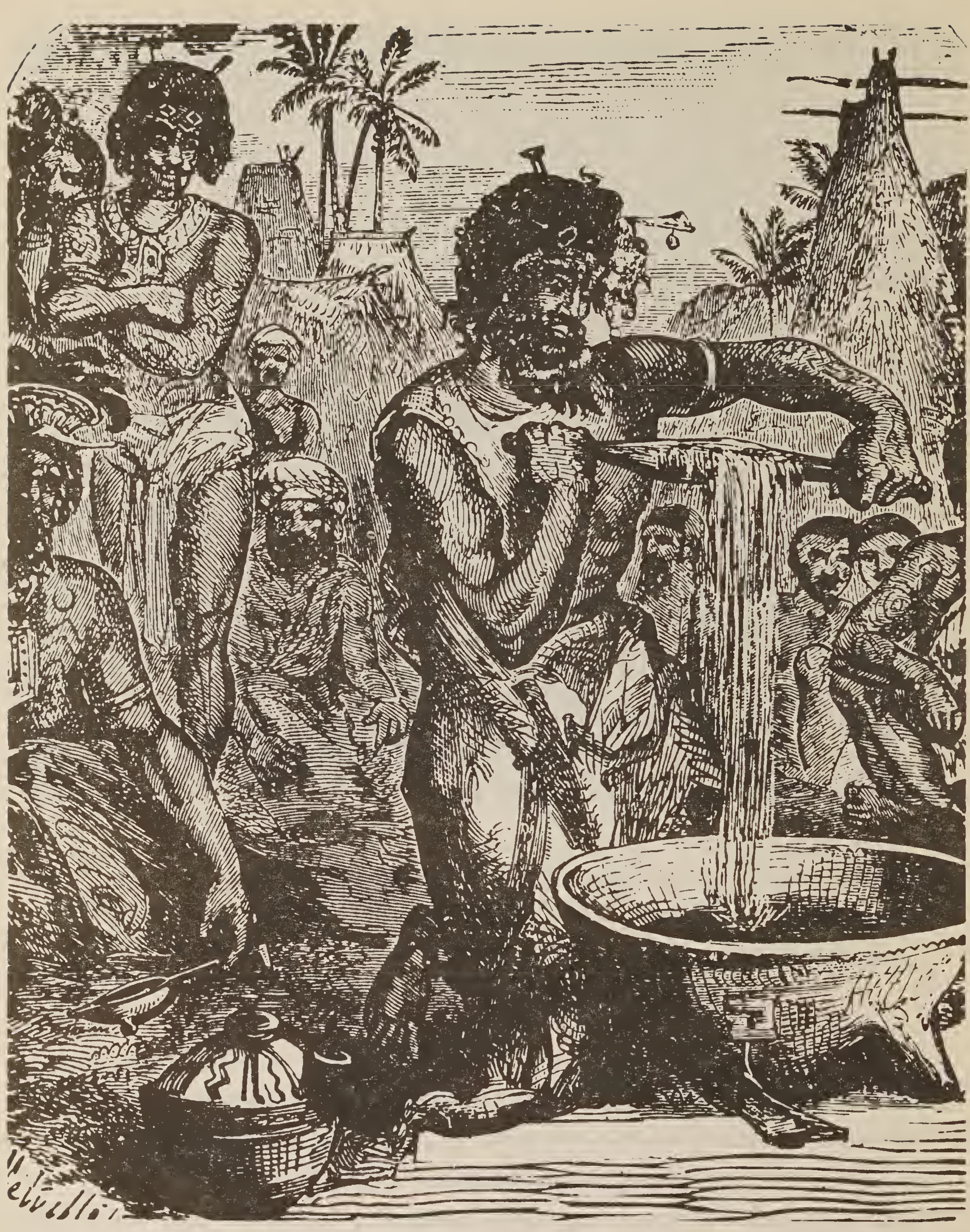
"Fau" shown in use, thrown on surface of contents of bowl. The people have evidently "dressed" for the picture. - Photograph - taken in the Samoan Islands - in the pharmacognostical collection of the School of Pharmacy, University of Wisconsin, U. S. A.

out in most of the Pacific islands[14]; drinking kava, prepared by chewing, is now an exception, not a custom.

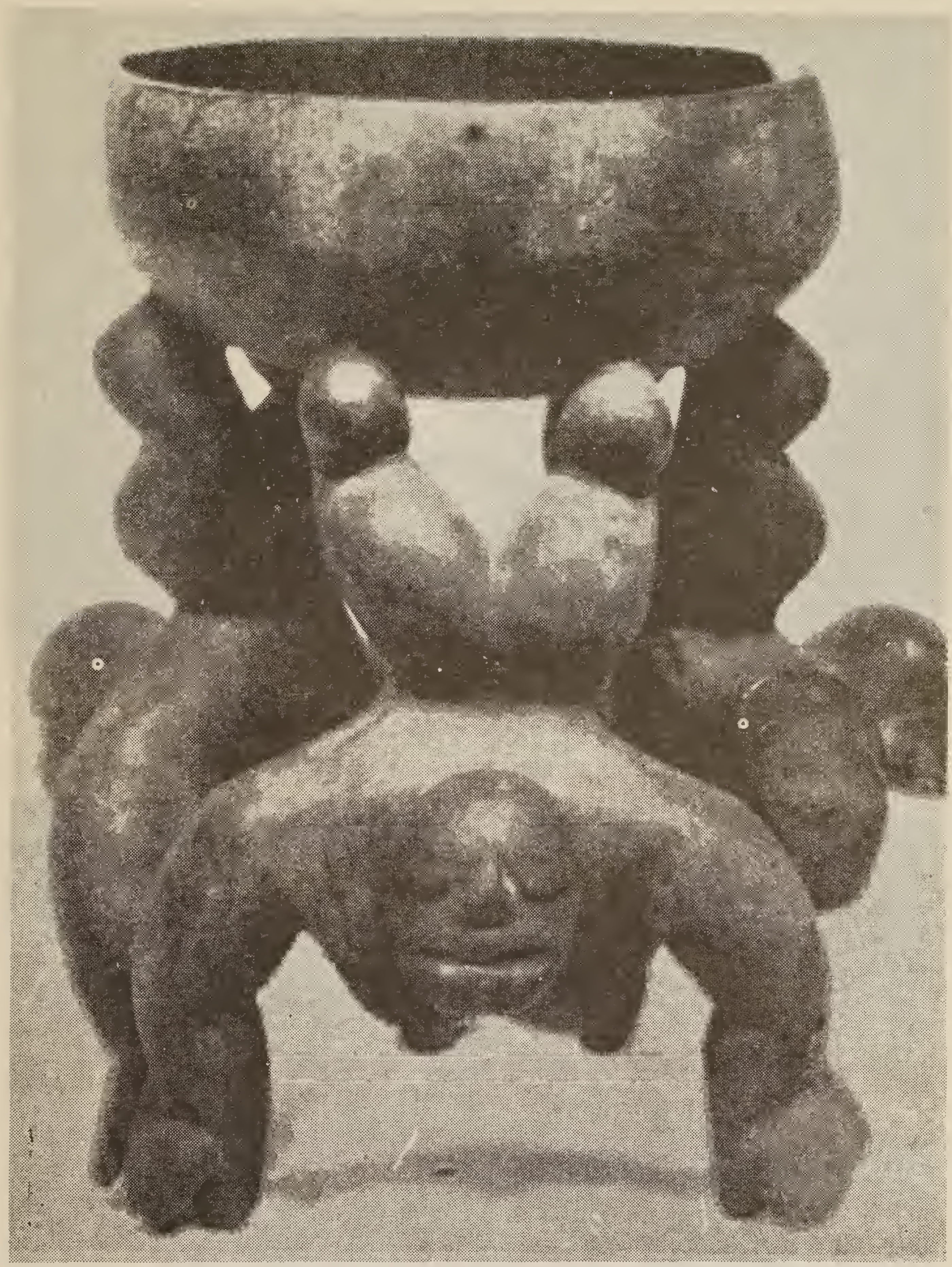
As the active principles are insoluble in water, but liberated in a process of emulsification - as will be seen in chapter 9 - it is apparent that the beverage prepared by merely macerating the rootstock in water has an effect quite different from the beverage prepared by chewing; these facts cannot be too strongly stressed.

Whichever way the beverage is prepared, it becomes stale within a few hours, so it must be consumed as soon as possible and finished off at one sitting in accordance with traditional custom.

Usually some water or coconut milk is drunk after the kava, or the mouth is rinsed, and a morsel of food taken; too much food would produce nausea. Kava grated or pounded and prepared by macerating in water, is often drunk copiously and does not require such caution.

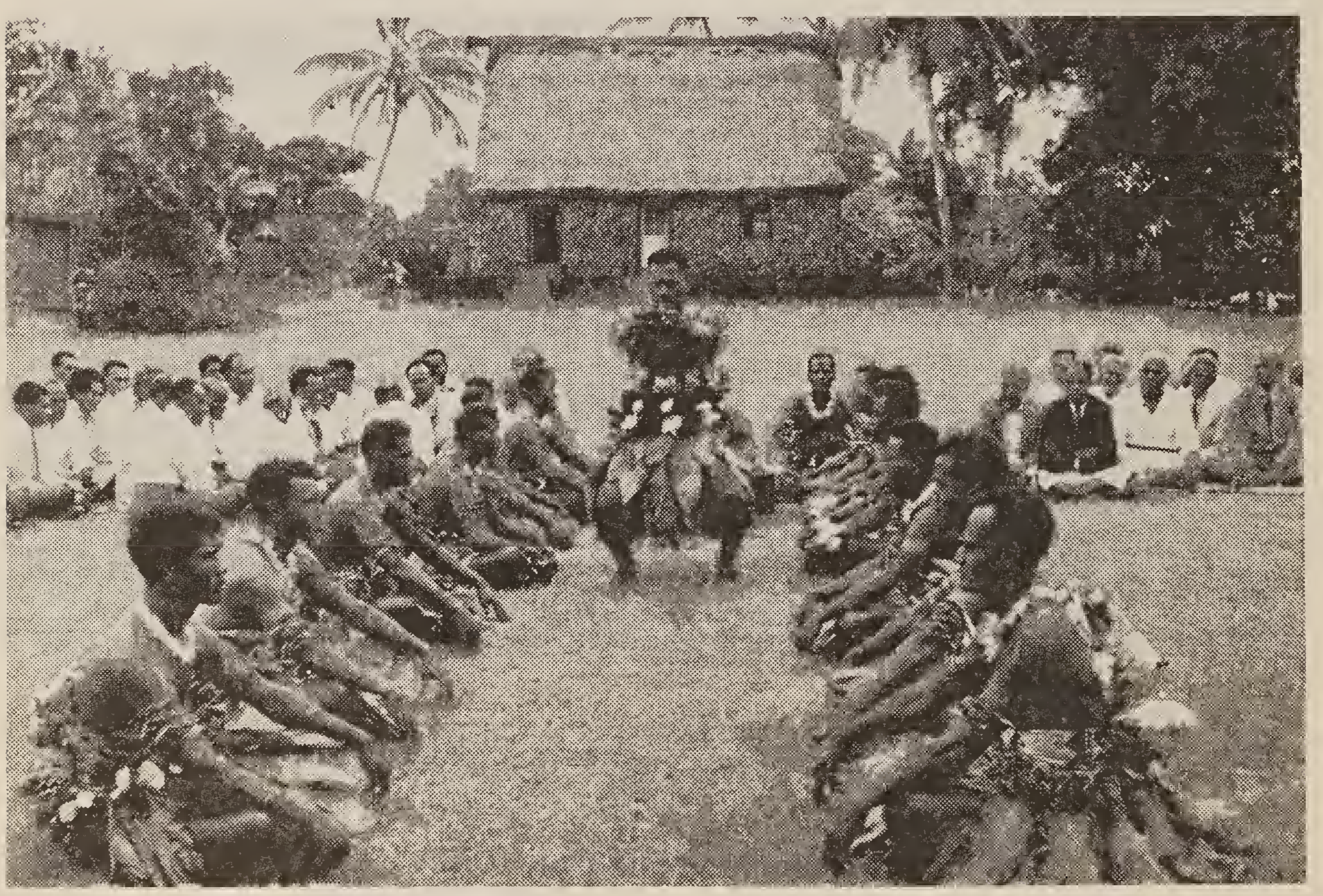


Kava beverage, wrung from "fau".
From cut in Captain Cook's "Three Famous Voyages around the world".
London. Ward, Lock & Co.



Elaborately carved kava bowl (called tanoa*).*
Through permission of Bernice P. Bishop Museum,
Honolulu (Hawaiian Islands).

Tonga natives making kava.
From "Kava drinking as practised by the Papuans and Polynesians"
by Walter Hough - Smithsonian Miscellaneous Collections, 1905.



Fijian kava ceremony. The cup bearer is about to present the cup ("bilo")
of kava = yaqona to the guest of honour (behind the camera).
The bowl ("tanoa"), in which the kava drink is made, can be seen
just behind the cup bearer.
Public Relations Office, Fiji. - Official photograph No. 8418.

Elaborately carved kava bowl (called tanoa*).*
Through permission of Bernice P. Bishop Museum, Honolulu (Hawaiian Islands).

CHAPTER 8

Effect of Kava Drinking

As has been pointed out before, the effect of the beverage prepared by chewing is QUITE DIFFERENT from that, caused by the beverage prepared by macerating after grating or pounding the rootstock.

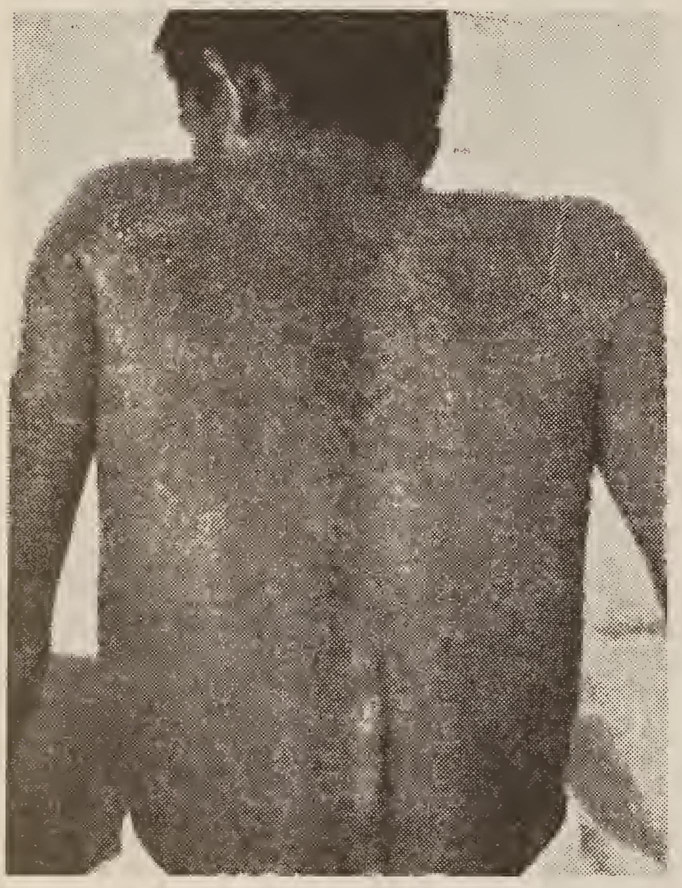
Kava prepared by chewing

Taken *in moderation*, kava prepared by chewing has a peculiar, narcotic action. It paralyses the sensory nerves and first stimulates, then paralyses the muscles, particularly affecting the lower limbs. It increases the force, but decreases the rapidity of the heart's action and at first stimulates, then depresses the respiratory centre. In striking contrast to alcohol, the drug does not impair mental alertness, until sleep comes. A small quantity gives rise to a euphoric state of short duration. The person, who took kava, does not talk loudly, fight or become quarrelsome; on the contrary, he is tranquil and friendly. In fact, the drinker manifests an unwillingness to be annoyed.

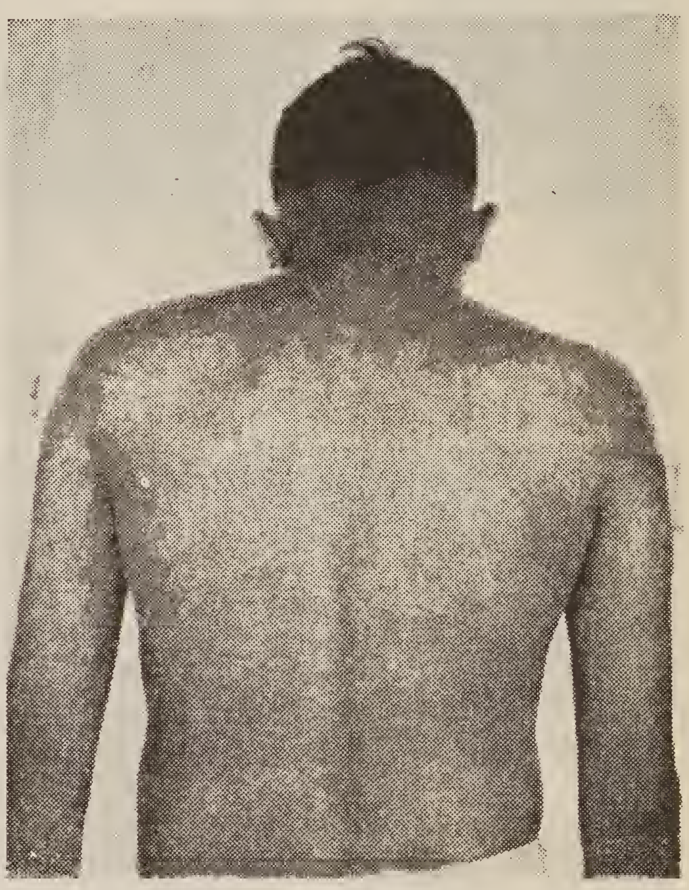
But if a person has drunk *too much* of the beverage, his vision becomes disturbed (the pupils are enlarged and react only very slowly to light), he staggers, walking is difficult or impossible, and all he wants to do is sleep. Kava has been described as "the most powerful soporific in existence"!

The universal opinion that kava possesses intoxicating powers, is not correct. Kava is a spinal rather than a cerebral depressant, since the higher nerve centres retain their normal functional activity. The drug steadies the pulse and does not raise the temperature. It also possesses diaphoretic, and slightly diuretic and stomachic properties. Kava counteracts obesity, a condition now unpopular in most of the Pacific islands. The Benedict test, used to determine whether sugar is present in urine, is positive in testing the urine of kava drinkers.

The qualities of the beverage are not lasting, although the drug contains sleep-producing active principles and produces muscular weakness. A wineglassfull of strong kava beverage is sufficient to produce - within half an hour - a profound *dreamless* sleep; in a soporific drug this quality is a very good one. After a few hours, by next morning, the kava drinker awakens "as fit as a fiddle" and his strength is restored;



Skin lesions (called kani *in Fiji) associated with the taking of kava (= yaqona) beverage prepared by chewing. Said to be curable by a full, balanced diet and reduced intake of kava.*



Skin of patient after treatment.

Photographs from Dr A. S. Prater in Transactions and Proceedings of the Fiji Society, Vol. 5, 1958. *Medical aspects of kava (=yaqona).*

there are no after-effects or evil consequences, such as the ,,hang-over" seen in cases of over-indulging in alcohol.

Too freely and too frequently imbibing kava is liable to give rise to skin lesions and weakening of the eye-sight; habitual kava topers are easily distinguished by their inflamed (bloodshot and suppurated) eyes, a scaly ulcerous appearance of the skin (sometimes erroneously diagnosed by physicians as ichthyosis vulgaris) and - in rare cases - general decrepitude. Kava drinkers can become emaciated. These effects are most commonly found in areas where the undried rootstock is consumed, and only if the beverage has been prepared by chewing, and is drunk liberally and regularly.

Kava prepared by grating or pounding.

As has already been stated, the beverage prepared by grating or pounding and macerating in cold water is a comparatively harmless drink, as its effect is QUITE DIFFERENT from that prepared by chewing; the effect of the former is *tonic and stimulant*, that of the latter *narcotic*. The beverage, prepared by the first method, is often given to the sick and convalescent. Pregnant women often also drink it, in the beliefthat it induces easy labour and promotes a flow of milk. Seeing that their natural food is not suitable for babies, young mothers in the Pacific islands are keen to take kava as a galactagogue.

The odour of kava is faint but characteristic (agreeable, lilac-like). Most islanders do not praise kava for its taste (which is very pungent, although not bitter); it is the odour which appeals to their sense of pleasure. Even the confirmed kava drinker makes a face and shakes his head when he swallows a potion.

As far as could be established, no pathology or ill-effects have been traced to kava drinking except in immoderate quantities, in spite of the fact that the beverage is "brewed" under the most unhygienic conditions, is frequently mixed with water of very doubtful purity, and is drunk from communal cups. It is, therefore, likely that kava possesses antibiotic properties.

As a curiosity it may be mentioned here, that female aborigines of certain parts of New-Guinea[15], who wish to have their bodies tattooed, swallow large potions of kava prepared by chewing, prior to the ,,beauty-treatment", in order to produce insensibility to the pain to be endured. Lacking proper instruments, the incisions in their skin are usually made with the aid of sharp pieces of shells, causing severe and even dangerous inflammations. They apparently do not mind suffering for being "beautiful".

New-Guinea - Tattooed women
Foto archief: Koninklijk Instituut voor de Tropen, Amsterdam

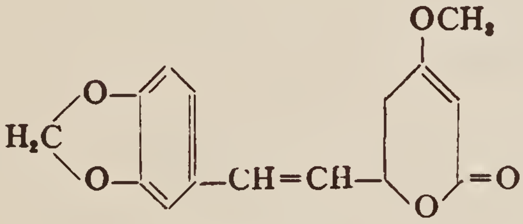
CHAPTER 9

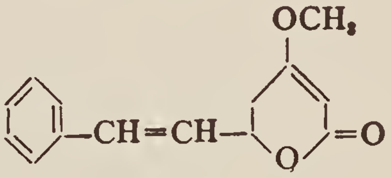
Chemical Composition

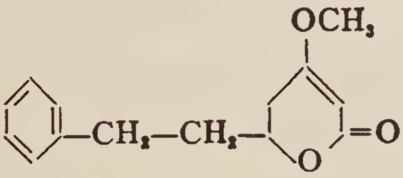
The earliest chemical examination of kava root seems to have been made by *M. Cuzent* in 1860, and about the same time by *Gobley* in collaboration with *O'Rorke*. *Gobley* found the air-dried rootstock to contain: cellulose 26 per cent, starch 49 per cent, methysticin (a crystalline principle) 1 per cent, an acrid balsamic resin 2 per cent (combined with an essential oil of a citron-yellow colour), moisture 15 per cent, and 7 per cent of gum and substances of minor importance which include 4 per cent ash or mineral matter (of which 1 per cent potassium chloride and 3 per cent calcium carbonate), and traces of magnesium, silicon, argillaceous earth and iron oxide. Tannin has never been found. According to *Gobley*, the active principle resides in the balsamic resin, contents of which have been variously estimated as between 3 and 8 per cent, although the figure depends on the age of the rootstock, and probably also on the methods used for its determination.

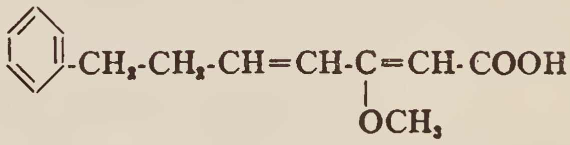
According to investigations made by *L. Lewin* (about 1866), a drop of kawaic resin on the tongue produces numbness (= local anaesthesia), and a fatty or soapy taste on the tongue and in other parts of the mouth, which come into contact with the resin. He concluded that kawaic resin is the only constituent of the rootstock, which has an anaesthetic effect. *Lewin* isolated what he termed alpha-kawaic resin and beta-kawaic resin, the former being the more potent. He found that this substance caused anaesthesia of the mucous membranes in a similar way to cocaine, and that if a tiny piece - the size of a needle head - of a mixture of both resins were put into the eye of an animal, a complete anaesthesia of the cornea and conjunctiva is produced within 3 minutes or even sooner. *Lewin* did not succeed however in isolating the principle in a crystalline condition.

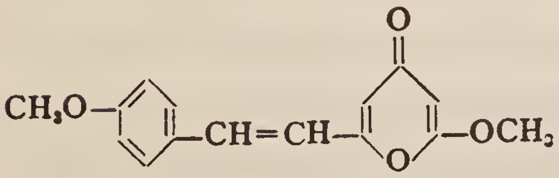
A painstaking systematic investigation of the drug was made by *W. Borsche* and his co-workers during the years 1913 to 1933, but although a number of chemical substances were isolated from the rootstock and their structure determined, the work failed to indicate the main active principle. Among the substances isolated were methysticin $C_{15}H_{14}O_5$, yangonin $C_{15}H_{14}O_3$ and kawain $C_{14}H_{14}O_3$ (a resinous substance, *insoluble in water*, but said to be soluble in gastric juices). Many of the compounds are lactones (organic compounds containing oxygen) and have a certain similarity in structure. *Borsche* tried to confirm the structure of kawain by synthesis, but failed and was forced to admit that none of his new substances had any physiological activity whatever. Nor did he realize that dihydrokawain plays an important part in the typical effect of the entire drug.

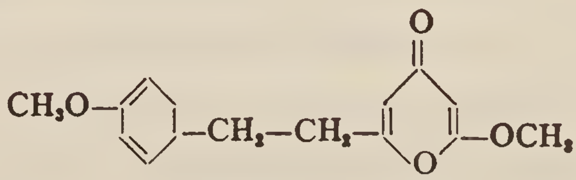

methysticin

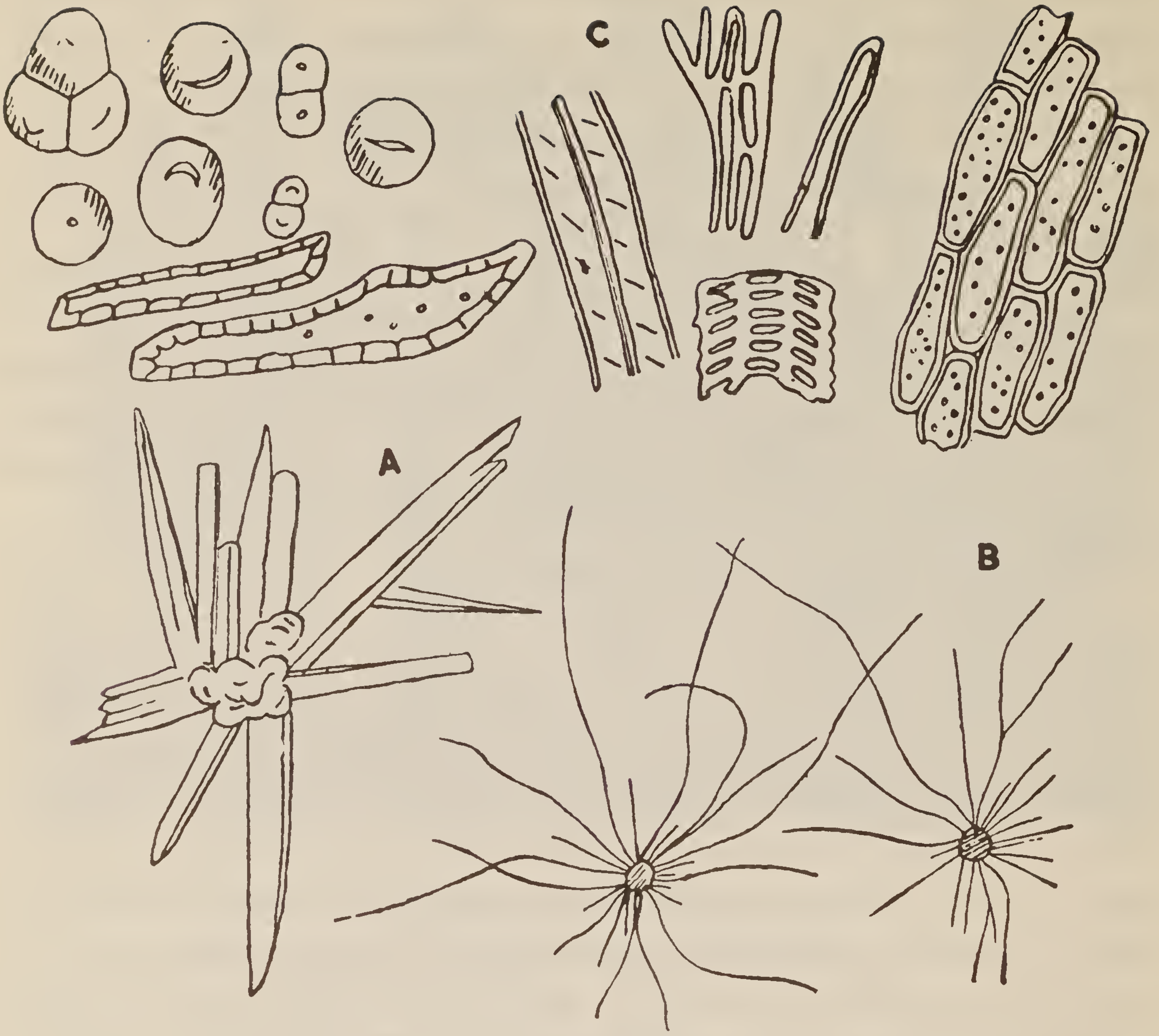

kawain


dihydrokawain


dihydrokawa-acid


yangonin


dihydroyangonin



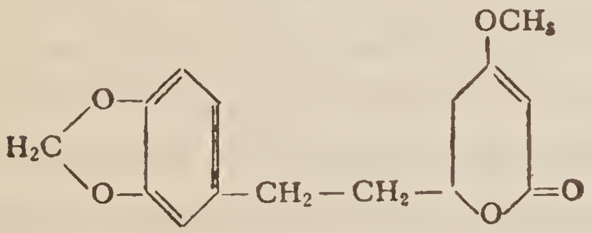
Microcrystals formed in kava, the rootstock of Piper methysticum: A, *crystals of methysticin obtained by treatment on sections of the rootstock or its powder with alcohol, the crystals being of a light yellow colour, attaining a length of* 0.160 *mm. and becoming violet red through the addition of sulphuric acid.* B, *crystals of methysticic acid obtained upon heating a small quantity of the powder with one or two drops of a solution of potassium hydroxide and adding dilute alcohol and allowing the slide to stand for* 24 *hours. Crystals of methysticin can also be obtained by sublimation, providing the powder has been acted on previously with dilute sulphuric acid, emulsin or saliva. - After Tunmann, in Gehe & Co's Handelsbericht*, 1912. - *From Henry Kraemer's Scientific and Applied Pharmacognosy*, 1920, *pp.* 153-154.

It was not until *A. G. van Veen* (about 1938) applied the modern technique of the adsorption column, that the active principle was finally and rather easily obtained, namely in crystalline condition by a combination of an appropriate method of extraction with adsorption analysis (chromatography). The most suitable adsorbent appeared to be well dried "acid clay", a particular argillaceous earth produced in Java; other sorts of alumina, franconite, etc. were not suitable. The ultimate purification with petrol-ether/ether mixtures as developer was much more troublesome. This crystallizable principle has been termed marindinin[16] $C_{14}H_{16}O_3$, melting point 60° C, named after the tribe of the Marindinese of Netherlands New-Guinea. It was subsequently shown to be identical with dihydrokawain, previously isolated by *Borsche* from the kawa resin, and is a tasteless, unsaturated lactone. It is soluble in alcohol and ether. This substance is narcotic only if it is brought into the form of a *fine emulsion.*

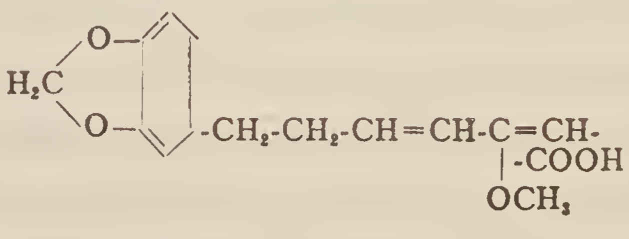
Van Veen made several tests as to the soporific effect of marindinin on pigeons and small monkeys (monkeys have the unpleasant habit of continuing to resist as long as possible the effect of a kava dose, which necessitates a very high dose), and he arrived at the conclusion that the only physiologically active constituent of the rootstock was dihydrokawain (marindinin), but likewise did not succeed in synthesizing the substance.

Other investigators also examined kava and found that it contained no glycosides, nor were alkaloids detected in the resin, although nitrogen was present.

Recently Prof. Dr *Rudolf Hänsel*, Berlin, again undertook to test kava rootstock as to soporific properties. He applied a new chromatographic method for the isolation of the ingredients, and he identified another sedative principle of the drug, dihydromethysticin. Doses of 50 to 200 mg/kg[17]. dihydrokawain and dihydromethysticin induced sleep in white mice and rats 20 minutes after application *per os* (through a stomach tube). *Hänsel* found that dihydrokawain (which is insoluble in water) is about 95 per cent soluble in groundnut oil at a temperature of 37° C; he, therefore, dissolved this ingredient in hot groundnut oil, cooled it to about 30° C, and applied the oily solution. But as to dihydromethysticin, no such solution could be obtained by this method, and *Hänsel* had to emulsify the rubbed crystals with gum arabic and groundnut oil in water. The formulae of dihydromethysticin and dihydromethysticic acid are:



dihydromethysticin

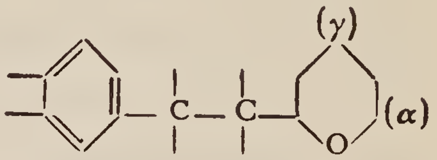


dihydromethysticic acid

Hänsel arrived at the same conclusion as *A. G. van Veen* did previously, namely that dihydrokawain (marindinin) constitutes the *central* principle of kava rootstock; he identified dihydromethysticin as *another* sedative ingredient of the drug. Dihydromethysticin does not act as quickly as dihydrokawain, however the effect of the former lasts longer. The other ingredients were found to be inactive. From 1 kg finely milled kava rootstock, *Hänsel* obtained 3.3 grams dihydrokawain and 4 grams dihydromethysticin.

The chemical formula of the kava ingredients (the 5 pyronone derivatives) is not complicated: a benzene ring is linked through a two-carbon side-chain with a pyronone ring; four of these ingredients - the kava lactones - namely methysticin, kawain, dihydrokawain and dihydromethysticin belong to the α-pyronone group, yangonin belongs to the γ-pyronone group.

Carbon-skeleton of the typical kava constituents



The unsaturated lactone ring is principally responsible for the narcotic effect of the kava ingredients. We know already from other unsaturated 6-membered lactones (as e.g. in the case of coumarin, and in the oil present in massoy bark), that unsaturated lactones can have such an effect, though in coumarin the effect is much weaker. For this reason it is remarkable, that in the case of the active principles of the kava drug (i.e., the dihydro-derivatives, viz. dihydrokawain and dihydromethysticin) - contrary to other lactones - the twofold binding in the carbon chain between the benzene ring on the one side and the 6-membered lactone ring on the other side is *hydrated;* after application of methysticin and kawain-compounds with intact lactone ring, no soporific effect could be observed!

Synthesis

In 1942 *K. Ziegler* discovered a method to brominate a system containing double bonds, without attacking these double bonds. By *Hänsel's* systematic investigation he arrived at the conclusion, that bromosuccinimide is an ideal brominating agent. This reaction was the origin of a simple synthesis of kawain. *F. Kögl* and *O. A. de Bruin* were the first to use this synthesis, and applied the method to the synthesis of auxin-b analogs. The synthesis was successful and, it was thought, kawain had been synthesized for the first time. However, another synthesis along quite another route was already announced by *E. R. H. Jones*, and the melting points of the substances, obtained from both methods, were found to be identical. Therefore ,we now possess two ways to synthesize kawain. Dihydrokawain was also synthesized, which had the melting point 76° C.

D, l-methysticin and d, l-dihydromethysticin have now been synthesized by Riker Laboratories, Inc., Northridge, Calif., U.S.A., Letter Patent 2.870.164.

Conclusions on the chemical composition

Though the problem of the synthesis of kawain and methysticin is solved, this does not provide products with the same *physiological* activity. This is probably because the action of kava is due not to one substance, but to a mixture of substances (synergistic action!), some of which are of secondary importance, but apparently nevertheless of real value, and including infinitesimal quantities of the inorganic ingredients, usually occurring as salts in plants, and which are termed trace minerals. It is a fact, that most medicinal plants owe their therapeutic activity largely - but not always exclusively! - to the presence of an active principle or principles. But it should also be realized that one substance is so dependent on the presence of another, that the plant or the part of the plant used in its entirety, often yields much better results in therapy than any of its isolated substances; indeed, the so-called ,,physiologically inert'' material in plants often constitutes an indispensable factor, and this ,,inert'' material is by no means needless bulk. This situation seems to be particularly true in the case of kava rootstock, because investigation has rendered it probable, that the potassium chloride (a salt present to the extent of about 0,04 per cent - already found by *Gobley*) - stands in a peculiar relation to the resin molecule, being apparently in chemical combination with it.

We have seen that most vegetable drugs contain more than one active principle, and that the principles present are similar in structure, and are mostly an extremely complex mixture of substances of quite different character. We learned from *Hänsel's* investigations, that as regards kava rootstock dihydrokawain is the most potent, but *not* the sole active principle.

As in the case of quite a number of vegetable drugs, the chemical processes employed in the isolation of medicinal organic substances can produce disturbances in the metabolism and structure of kava rootstock and, therefore, in its properties, which are retained when the drug is used in its crude state, in the form of a *suitable* galenical preparation. In this connection it should be realized that - when a medicine is prepared through infusion or decoction of a dried plant or a part of a plant - the enzymes (complex protein materials which act in the living cells of plants as a catalyst, and increase metabolic activity and breakdown of the substrate) can be *destroyed*. But when extracts or tinctures are prepared by COLD maceration, the enzymes are *preserved.* In fact, in some instances the value of a vegetable drug is due entirely to the products of enzyme action. In this connection it should be pointed out here, that on the South Pacific islands, kava beverages are always prepared with *cold* water or coconut milk.

Although the active principles of kava rootstock are narcotics, for them to be active it is essential that they be brought into the form of a *fine emulsion*, before they can exert their narcotic properties. This is the main explanation of the differential action of the drug, when used as a drink prepared after grating or pounding and macerating in water, and a beverage prepared by chewing[18].

It is possible and highly advantageous to replace saliva by water, without loss of narcotic activity, but the finely milled material should be rubbed for a sufficiently long time in a mortar or with the aid of modern techniques; it should then be emulsified with a little oil (not a heavy oil, but - for instance - olive oil or coconut oil) and lecithin, so that a milky substance is obtained.

CHAPTER 10

Kava Rootstock in Therapy

The rootstock found its way to Europe and America, and is known in pharmacy as RHIZOMA PIPERIS METHYSTICI (= RHIZOMA KAVAE) or Kava-Kava (Kawa-Kawa).

The drug has been used in the form of an alcoholic extract in a number of proprietary and secret medicines, chiefly as an antiseptic remedy in the treatment of chronic irritation of the genito-urinary tract, specially that which is due to gonorrhoea, and catarrh of the urethra and of the bladder. The drug has a marked action in reducing the acidity of the urine and may be given with benefit in cases where there is an uric acid predisposition.

Marpmann (1905) demonstrated, that the constituent kawain possesses bacteriological properties, especially for the gonococcus, but also for the coli bacillus. For these purposes, the drug is usually prescribed in the form of 1 part of the fluid-extract or dry extract made from the resin[19] obtained from the crude drug, dissolved in 4 parts of sandalwood oil[20], and given in capsules, but it is too irritant to be employed for acute conditions.

On the South Pacific islands, where kava prepared by chewing was regularly taken, gonorrhoea was rare, whereas e.g. in Tahiti - where little kava was consumed - cases of gonorrhoea were very numerous. In the days when white men invaded the South Pacific islands, where kava drinking was the regular custom, many of the European sailors had gonorrhoea; chronic cases of this disease, as well as cases of chronic cystitis, are reported to have been cured within a few days by the natives with the help of kava.

In the treatment of hypertension, bronchitis, diarrhoea, gout, rheumatism, nephritic colic, dropsy, colpitis (vaginitis), gonorrhoeal urethritis, metritis, salpingitis, enteritis and nocturnal incontinence of urine due to muscular weakness, the drug has also been stated to be useful, in order to check inflammatory discharge and to relieve pain; this is one more reason to thoroughly investigate the clinical properties of the drug. The drug is also stated to produce reflex excitability.

Since the discovery of the sulphonamides and penicillin, the importance of balsamic drugs - such as kava - in the treatment of venereal and other diseases has greatly declined. But the *dual* action (narcotic *and* antiseptic) of kava rootstock in the form of an *emulsion* makes it highly possible that the drug can be used successfully in a number of gynaecological, urological and other diseases; the drug certainly deserves to be tested clinically on a wide variety of diseases, seeing that the antibiotics and penicillin not infrequently cause considerable side-effects, and also because penicillin sometimes fails.

As a purely antiseptic remedy, the drug is usually prescribed in the following daily doses:

powdered root: 2 drams = 120 grains = about 8 grams
fluid-extract: 1 dram = 60 grains = about 4 grams
dry extract: 5-15 grains = 0.325-1 gram,

divided into 3 or 4 portions, and taken *per os* after meals.

If, in the past, the medicament did not always give satisfactory results, it is pointed out here again, that the drug can exert its full antiseptic properties if it is used in its crude state in the form of a suitable galenical preparation, and that it can exert its *dual* action (antiseptic *and* narcotic) *only* if it is administered in the form of a thorough *suspension.*

There is good reason to believe that the physician can use the drug - in the form of an emulsion for oral administration - among other purposes - as an excellent tranquillizer, sedative and somnifacient medicine, in many cases in preference to morphine, etc.[21]

The author can offer no explanation with respect to the assumed value of the drug as an aphrodisiac, but the euphoria of short duration - mentioned in chapter 8 - may exercise some influence on the organs of reproduction as well. The general opinion is however, that kava depresses sexual desires in the long run, and there exists a belief among the inhabitants of the South Sea islands, that kava renders women barren; these statements seem never to have been confirmed nor denied. It is very difficult to get reliable information from the natives on these points.

There is a danger of addiction and in the use of excessive doses of an emulsion, for - as has been said in chapter 8 - intemperate potions of the beverage prepared by chewing can have a fatal effect; an emulsion might well be compared with the native beverage prepared by chewing, since saliva in the latter and sub-division of the rootstock do practically the same to the crude drug as do water and oil in the process of intense emulsification through hygienic techniques.

We have thus learned that the active principles dihydrokawain (marindinin) and dihydromethysticin can be liberated from the crude rootstock through a process of emulsification (chewing or modern technique), and that these principles - if chemically isolated - also need to be dispersed if a narcotic effect is aimed at. We learned too that a beverage prepared by maceration is merely a tonic, stimulant and antiseptic. The statement in chapter 9 , that the active principles are supposed to be soluble in gastric juices, requires further investigation.

In homoeopathy, an extract of the rootstock, mostly with its adherent root, is recommended in cases of cerebral congestion, fatigue and neuralgic headache. According to homoeopathic theory, homoeopathic doses have an effect different from that of allopathic doses.

From the foregoing we see, that it is highly possible that the drug can be used successfully in medical practice for a number of diseases, so that pharmacologists, pharmacognosists, clinicians and other research workers may do excellent work in investigating the therapeutic virtues of the rootstock. It is a well known fact, that scientific knowledge is often gained step by step, and that the quintessence of a problem is discovered in the course of progress only.

Recapitulation

1 Kava rootstock used in the form of a maceration, taken internally, has merely a tonic, stimulant and antiseptic action,
2 the crude drug can exert its dual action - narcotic *and* antiseptic - only when made into the form of a suspension,
3 chemically isolated active principles (dihydrokawain = marindinin, and dihydromethysticin) must be brought into the form of an emulsion to be physiologically active as a narcotic; they have perhaps an antibiotic effect, if not emulsified. It appears that isolation of the

active principles is only possible in low yields and by tedious methods, and that it is far better to use the crude drug in its entirety,

4 kava rootstock is worthy of further exhaustive investigation, particularly as regards the narcotic resin it contains.

5 the formation of *stable* medicinals should be aimed at.

Piper Methysticum

From a drawing in the collection of the late Sir Joseph Banks, in the British Museum.

Notes

[1] Methysticum, Latin transcription of Greek methustikos (from methuein, derived from methu = intoxicating drink).

[2] Macropiper, from Greek makros = long (often erroneously used in the sense of large) + pepper.

[3] From Latin decumanus = very large, imposing.

[4] Inebrians from Latin inebriare (ebrius: intoxicated), to make drunk or to intoxicate.

[5] Named after the Russian traveller N. von Miklucho-Maclay.

[6] The names kava and kawa are probably transcriptions of the Sanscrit word Kashya, meaning intoxicating drink; ,,v'' and ,,w'' often being interchanged.

[7] The natives of Tahiti call all pungent drinks ,,ava''.

[8] i.e., staminate flowers on one plant and pistillate flowers on another.

[9] Taro = Talo = Dalo (*Colocasia antiquorum* = *Colocasia esculenta*), the cooked tubers of which are eaten as a vegetable, is commonly interplanted with kava during the first year.

[10] Coconut milk has the advantage over water that it does not affect the odour of the beverage.

[11] This is quite a dexterous manipulation and an art, often performed very gracefully. An old *fau* is preferred to a new one, as the acrid quality of the fibre of the latter has not been washed away by frequent use.

[12] Usually young girls with rosy lips and pearly teeth were chosen for their prepossessing appearance, and young lads who occupied a certain social rank towards the man. for whom they performed the office. The girls, sitting cross-legged on mats on the ground, breasts bare, with flowers coquettishly stuck in their hair, and only a very slight drapery of native cloth (often a band, curiously worked of grass and bark of different colours) round the waist, made a very pretty picture; the girls' beauty was supposed to counteract the filthy method of preparing the "nectar". In most of the Pacific islands this method of letting girls and boys or others chew the rootstock is now forbidden by law, owing to its liability to spread disease; it also destroys the teeth in the course of time.

[13] These bowls can contain from 4 to 10 pints. In very old and much used bowls, a grayish-white or yellowish-green crust with a bluish or purplish glitter was formed in course of time, which finally resulted in a pearly-bluish colour. After a period of 20 years, this coating was sometimes half an inch thick, and looked as if the bowl had been inlaid with mother-of-pearl. It is formed by the resinous substance kawain, a substance insoluble in water, which is set free in the chewed mass. As the chewed mass is mixed with water and stirred, particles of the yellowish or greenish-yellow kawain, together with particles of the grayish powder of the rootstock, stick to the inside of the bowl, and so this coating is gradually formed. A similar coating is formed in coconut shells, which are used as drinking cups (these shells are scraped and rubbed with stones under water into a thin, highly polished cup). Neither the bowls nor the cups are ever wiped dry after having contained kava, but are simply emptied. Sometimes the coating is scraped off; a beverage prepared therefrom forms an exceedingly strong drink, the active principles of the rootstock having been liberated by the process of chewing.

[14] In the Hawaiian Islands, during the middle of the last century, laws forbidding the use of kava, except on medical advice, were passed but not strictly enforced.

[15] In some parts of New-Guinea (where the kava plant and rootstock are called *wati*), a beverage called "*koi*" in some places is still made by the Papuans through the chewing method. The chewing is done by men, boys and girls. Mostly, only the grown-up males partake of the beverage on occasions of feasting. The Papuans appear to mix it with a much smaller quantity of water then the natives of the South Sea islands usually do, and thus their beverage is much stronger.

[16] Fresh kava rootstock, roots and stem about one year old contain about 0.2 per cent marindinin; dried material contains about 1 per cent. The older drug contains 2 or 3 times as much of this substance.

[17] These high doses were purposely chosen in order to check possible side-effects;

however no side-effects were noticed. It is not impossible that both substances are also active in a much smaller dose.

[18] Earlier observers (*K. Schübel* and others) frequently supposed this difference was due to the saliva setting free a more active principle, believed at that time to be alkaloidal in nature. However, the mastication of rootstock and stems and consumption of the expressed juice — as practised by the natives of the South Pacific islands — *does not cause a fermentation* of the material by the enzymes (ptyalin) in the saliva, resulting in an activation of the active substances, but an *intense emulsification*, by which the active substances are more completely and readily resorbed, and consequently the narcotic action shows itself decidedly. — When macerating the rootstock and keeping the preparation 3 or 5 days at summer temperature, no fermentation takes place.

[19] As pointed out in the previous chapter, the resin is likely to be disturbed in the process of isolation; also the resin had probably not been emulsified.

[20] In the treatment of gonorrhoea, sandalwood oil plays an important therapeutic part.

[21] According to investigations of *Baldi*, an alcoholic solution of the isolated kawain, injected hypodermically, occasions local anaesthesia for several hours or even for a number of days; if the quantity injected be sufficiently large, the local effect is followed by a paralysis of the peripheral nerves. It follows, that the drug cannot be safely employed as a local anaesthetic, except — perhaps — in a very small dose.

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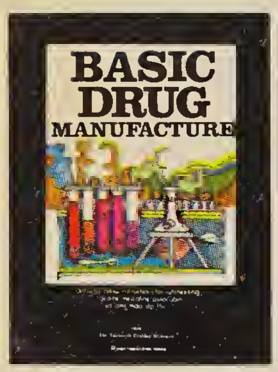

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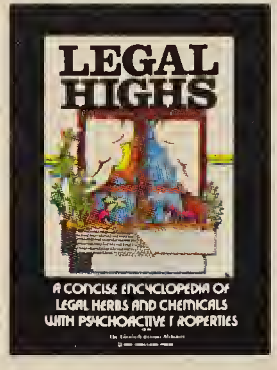
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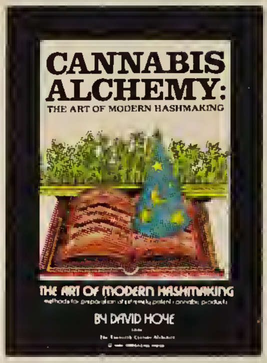

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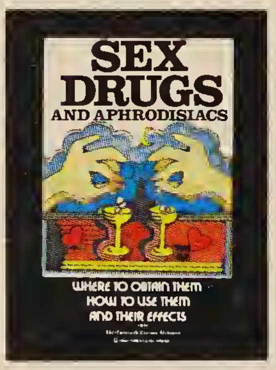

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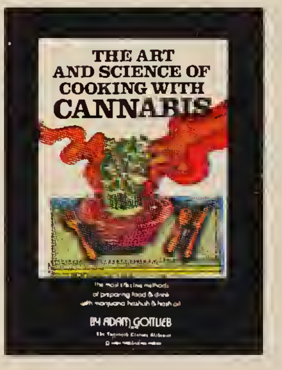

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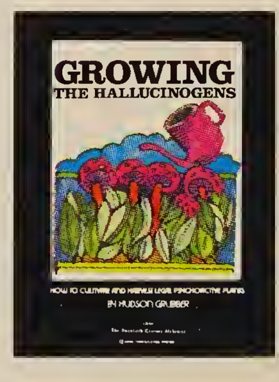

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